

### 7.3 Solve linear systems using elimination.

Goal • Solve linear systems using elimination (addition).

#### SOLVING A LINEAR SYSTEM USING THE ELIMINATION METHOD

Step 1 Rearrange the equations so that they are both in standard form.

$$\begin{aligned} Ax + By &= C \\ Dx + Ey &= F \end{aligned}$$

Step 2 Determine if the coefficients of one of the variables are opposites.

If they aren't, multiply one of the equations by -1 (changes the sign of the terms).

Step 3 Add the equations to eliminate one variable.

Step 4 Solve the resulting equation for the other variable. - gives one coordinate

Step 5 Substitute in either original equation to find other coordinate.

Step 6 Check your solution in the original equations.

Example 1 *Use addition to eliminate a variable*

Solve the linear system:  $x + 5y = 9$   
 $4x - 5y = -14$

Equation 1

Equation 2

Solution

1. Add the equations to eliminate one variable

$$\begin{array}{r} + \quad \begin{array}{l} 1x + 5y = 9 \\ 4x - 5y = -14 \\ \hline 5x = -5/5 \end{array} \quad (-1, 2) \\ \hline x = -1 \end{array}$$

2. Solve for x

3. Substitute -1 for x in either equation and solve for y.

$$\begin{array}{l} x + 5y = 9 \\ -1 + 5y = 9 \\ +1 \quad 5y = 10 \\ \hline y = 2 \end{array}$$

Write Equation 1.  
Substitute -1 for x.

Solve for y.

The solution is (-1, 2).

Make sure to check your solution by substituting it into each of the original equations.

**Example 2** Multiply by  $-1$  and use addition to eliminate a variable

Solve the linear system:  $3x - 4y = 2$  Equation 1

$3x + 2y = 26$  Equation 2

**Solution**

1. Multiply one of the equations by  $-1$  and add to eliminate one variable

$$\begin{array}{r} (3x - 4y = 2) \cdot -1 \\ \hline 3x + 2y = 26 \end{array}$$

$$\begin{array}{r} -3x + 4y = -2 \\ + 3x + 2y = 26 \\ \hline 6y = 24 \\ \hline y = 4 \end{array}$$

2. Solve for  $y$

$y = 4$

3. Substitute 4 for  $y$  in either equation and solve for x.

$3x + 2y = 26$

Write Equation 2.

$3x + 2(4) = 26$

Substitute 4 for  $y$ .

$3x + 8 = 26$

$x = 6$

The solution is  $(6, 4)$   
Check your solution:

$(6, 4)$

Solve for  $x$ :

$\frac{3x}{3} = \frac{18}{3}$

$3(6) - 4(4) \stackrel{?}{=} 2$

$3(6) + 2(4) \stackrel{?}{=} 26$

$x = 6$

$18 - 16 \stackrel{?}{=} 2$   
 $2 = 2 \checkmark$

$18 + 8 \stackrel{?}{=} 26$

$26 = 26 \checkmark$

**Checkpoint** Solve the linear system using elimination.

1.  $-8x + 3y = 12$

$+ 8x - 9y = 12$

$-6y = 24$

$y = -4$

$-8x + 3(-4) = 12$

$-8x - 12 = 12$

$-8x = 24$

$x = -3$

Check:  $-8(-3) + 3(-4) \stackrel{?}{=} 12$

$24 - 12 \stackrel{?}{=} 12$

$12 = 12 \checkmark$

$8(-3) - 9(-4) \stackrel{?}{=} 12$

$-24 + 36 \stackrel{?}{=} 12$

$12 = 12 \checkmark$

2.  $(x + 6y = 13) \cdot -1$

$-2x + 6y = -8$

$+ -x - 6y = -13$

$-2x + 6y = -8$

$-3x = -21$

$x = 7$

$7 + 6y = 13$

$6y = 6$

$y = 1$

$(7, 1)$

check:  $7 + 6(1) = 13$   
 $13 = 13 \checkmark$   
 $-2(7) + 6(1) \stackrel{?}{=} -8$   
 $-14 + 6 = -8$   
 $-8 = -8$